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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	
Robert A SHEPHERD, JR. et al.	Docket No. NOVEP015
Application No. 10/006,100	Group Art Unit: 1763
Filed: December 3, 2001	Examiner: Rudi Zervignon
For: METHOD AND APPARATUS FOR PLASMA	Date: July 16, 2004

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450 on **July 16, 2004**.

Signed: Diane Schwanbeck
Diane Schwanbeck

TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION – 37 CFR 192)

Mail Stop: Appeal Brief - Patents
Commissioner for Patents
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is in furtherance of the Notice of Appeal filed in this case on May 14, 2004. This Appeal Brief is transmitted in triplicate.

This application is on behalf of:

☐ Small Entity ☒ Large Entity

Pursuant to 37 CFR 1.17(f), the fee for filing the Appeal Brief is:

☐ $165.00 (Small Entity) ☒ $330.00 (Large Entity)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136 apply:

☐ Applicants petition for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

Months	Large Entity	Small Entity
☐ one	$110.00	$55.00
☐ two	$420.00	$210.00
☐ three	$950.00	$475.00
☐ four	$1,480.00	$740.00

If an additional extension of time is required, please consider this a petition therefor.

☐ An extension for __ months has already been secured and the fee paid therefor of $ is deducted from the total fee due for the total months of extension now requested.

☒ Applicants believe that no extension of term is required. However, this conditional petition is being made to provide for the possibility that Applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Total Fees Due:

Appeal Brief Fee	$330.00
Extension Fee (if any)	$_____
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☒ Enclosed is Check No. 12091 in the amount of $330.00.

☒ The Commissioner is authorized to charge any additional fees or credit any overpayment to Deposit Account No. 50-0850 (Order No. NOVEP015). Two copies of this transmittal are enclosed.

Respectfully submitted,
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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

EX PARTE ROBERT A. SHEPHERD, JR. et al.

Application for Patent

Filed December 3, 2001

Application No. 10/006,100

FOR:

METHOD AND APPARATUS FOR PLASMA OPTIMIZATION IN WAFER PROCESSING

APPEAL BRIEF

CERTIFICATE OF MAILING

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Signed: _____
Diane Schwanbeck

MARTINE & PENILLA, LLP
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REAL PARTY IN INTEREST

The real party in interest is Novellus Systems Inc., the assignee of the present application.

RELATED APPEALS AND INTERFERENCES

The undersigned is not aware of any related appeals or interferences.

STATUS OF THE CLAIMS

Claims 1-23 are pending in the subject application. Claims 1-23 have been twice rejected and are on appeal.

STATUS OF THE AMENDMENTS

Applicant has not submitted an amendment subsequent to receiving a non-final rejection mailed to Applicant after filing a Request for Continued Examination (RCE).

SUMMARY OF THE INVENTION

The subject invention is directed towards managing plasma during wafer processing operations. Multiple embodiments of the subject invention include pathways within a housing that permits plasma mixed with a gas to traverse the housing. Specifically, the housing can include multiple misaligned baffle plates, multiple spaces with misaligned orifices and ports, and holes of a hollow tube within the housing that control the traversal of the mixed plasma/gas within the housing. For example, an apparatus of the present invention includes a housing that includes a fluid entry port and a fluid exit port. Within the housing are multiple baffle plates that define levels in a multilevel structure of an internal region. Each baffle plate includes multiple

holes that are misaligned. The misaligned holes define a nonlinear path for plasma entering the fluid entry port to traverse each level of the multilevel structure defined by the multiple baffle plates. The plasma (generated outside the housing) mixes with a gas injected into the housing within at least one level of the internal region. The gas mixes with the plasma and traverses the nonlinear path to the fluid exit port.

ISSUE

Whether Claims 1-17 are Patentable under 35 U.S.C. § 103(a) over Moslehi et al. (U.S. Patent No. 5,217,559) in view of Notman (U.S. Patent No. 4,311,671) and Claims 18-23 are Patentable under 35 U.S.C. § 103(a) over Moslehi et al. in view of Rudolph et al. (U.S. Patent No. 5,480,678).

GROUPING OF THE CLAIMS

For purposes of this appeal only, claims 1-17 stand or fall together (Group I); and claims 18-23 stand or fall together (Group II).

ARGUMENTS

The Combination of Moslehi et al. in View of Notman Would Not Have Suggested to One Having Ordinary Skill in the Art the Subject Matter of Claims 1-17.

Claims 1-17 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Moslehi et al. in view of Notman. Applicants traverse the rejection.

As previously cited to the Examiner in an earlier amendment, distilling an invention down to the "gist" or "thrust" of an invention disregards the requirement of analyzing the subject matter "as a whole (*W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984); MPEP 2141.02)." As the Examiner is aware, when applying 35 U.S.C. § 103, the

claimed invention must be considered as a whole, the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention, and a reasonable expectation of success is the standard with which obviousness is determined (*Hodash v. Block Drug. Co. Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986); MPEP 2141). Thus, the Examiner should have considered Moslehi et al. and Notman as a whole and further, the references must suggest the desirability and the obviousness of making the combination.

Applicants' independent claim 1 recites a housing that defines a nonlinear path for fluids to enter the entry port such that the fluids "traverse each level" formed by misaligned baffle plates. The fluids are "capable of mixing together at each level of the multilevel structure and leave the exit port of the housing." Further, a gas inlet port is configured to "inject gas into the housing in at least one of the separation spacing" thus permitting mixing to occur within the spacing of the plasma and injected gas. Independent claim 2 further describes fluid mixing and fluid traversal within two chambers by reciting that an input port supplies plasma into the first chamber, which then mixes with a fluid that is supplied through at least one fluid input. The chambers permit the fluid and the plasma to mix and an output port of a second chamber outputs the mixed fluid/plasma. Thus, as recited by independent claims 1 and 12, fluids mix, such as a gas and plasma, by traversing nonlinear paths within the housing.

Further, the Merriam Webster Online Dictionary, available at http://www.m-w.com/cgi-bin/dictionary?book=Dictionary&va=plasma defines the word plasma as

> a collection of charged particles (as in the atmospheres of stars or in a metal) containing about equal numbers of positive ions and electrons and exhibiting some properties of a gas but differing from a gas in being a good conductor of electricity and in being affected by a magnetic field.

Thus, plasma exhibits some properties of a gas, but is different from a gas by being a good electrical conductor and has the property of being affected by a magnetic field. Plasma enters Applicants' housing and mixes with a gas injected into the area of the housing containing the plasma. The plasma and the gas mix and traverse a nonlinear path to exit the area.

The Examiner emphasized in the Office Action mailed on February 17, 2004, that "the fluids [are] capable of mixing together at each level of the multilevel structure (Figure 4; column 10, lines 17-41)." However, Applicants carefully reviewed the citation in column 10 to learn that a "control gas 160...operates as a switch" to either permit process plasma 120 to reach the wafer or prevent plasma 120 from reaching the wafer. Specifically, Moslehi et al. discloses that the control gas flow *blocks the flow of plasma* upward to the wafer. This permits Moslehi et al.'s reactor 10 to operate in two discrete modes of plasma processing and photochemical processing mode.

Moslehi et al. further discloses that other embodiments include a plasma-assisted mode, a completely deep ultraviolet photo assisted photochemical mode, or in a combined mode. See column 13, lines 41-46. What the reference fails to disclose is the mixing of plasma and a gas (among other features defined in the independent claims as a whole). Instead, the reference teaches that deep ultraviolet photons, which is light, and not a gas or even similar to a gas, irradiate the wafer. The reference also teaches that light and plasma affect the wafer. However, these teachings do not teach or suggest mixing plasma and a gas, as recited by Applicants' independent claims.

Further Notman, synthesizes methanol and ammonia, which are chemicals that are destructive to wafers. Taken as a whole with Moslehi et al., which discloses a housing for semiconductor wafer processing using plasma and light, the Examiner did not properly ascertain what would have been obvious to one of ordinary skill in the art at the time the invention was made, and not to the inventor, a judge, a layman, ***those skilled in the remote***

arts, or to geniuses in the art at hand (*Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 218 USPQ 865 (Fed. Cir. 1983), *cert denied*, 464 U.S. 1043 (1984); MPEP 2141.03). Applicants respectfully submit to the Board that one of ordinary skill in the art, even if Notman was appropriate to combine with Moslehi et al., would not be motivated to combine the references because Moslehi et al. would have taught one of ordinary skill to mix plasma and light. Specifically, a reference that teaches mixing plasma and light when combined with a reference that teaches the creation of methanol and ammonia, which would destroy wafers, does not teach or suggest mixing plasma and a gas using misaligned spaces in a wafer processing housing.

Regarding dependent claims 2-11 and 13-17, which depend from independent claims 1 and 12, respectively, Applicants respectfully submit to the Board that the dependent claims are allowable for at least the same reasons as independent claims 1 and 12. Accordingly, the obviousness rejections of claims 1-17 are improper and should be withdrawn.

The Combination of Moslehi et al. in View of Rudolph et al. Would Not Have Suggested to One Having Ordinary Skill in the Art the Subject Matter of Claims 18-23.

Claims 18-23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Moslehi et al. in view of Rudolph et al. Applicants traverse the rejection and respectfully submit to the Board that much of the remarks traversing the section 103 rejection above with respect to independent claims 1 and 12 also apply with respect to claims 18-23.

Independent claim 18 recites a housing for mixing plasma and a fluid. Referring to Moslehi et al., which teaches mixing light and plasma, one of ordinary skill will recognize that fluid is not equivalent to light. Further, the Applicants' housing includes a hollow tube with multiple orifices that permit the fluid to enter the hollow tube to mix with the

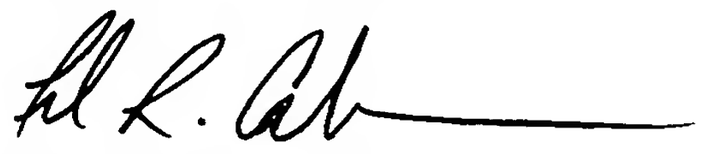
plasma. The mixture then exits the housing. However, referring to Rudolph et al., the Examiner asserts that the hollow tube (122, Figure 4; column 12, lines 46-48) conduit (17, Figure 6) of the reference is applicable to Moslehi et al. However, "hollow tube 144" and "conduit 17" as characterized by the Examiner are taught by the reference to be upper and lower rings 122 and a plurality of perforated inlet legs 17, respectively. Thus, it is unclear that Rudolph et al. teaches a hollow tube conduit that is perforated.

Further, Rudolph et al.'s teachings in combination with Moslehi et al.'s teaching of mixing light and plasma, does not teach or suggest the hollow tube mixing plasma and fluid, as recited by independent claim 18. Accordingly, the rejections of claim 18-23 under 35 U.S.C. § 103(a) as being unpatentable are improper and should be reversed.

CONCLUSION

For the foregoing reasons, the rejections of claims 1-23 under 35 U.S.C. §103(a) are improper and should be reversed. When considered objectively, without the benefit of Applicants' teachings, the combination of Moslehi et al. in view of Notman, and Moslehi et al. in view of Rudolph et al. do not establish a *prima facie* case of obviousness against the claimed invention. Accordingly, Applicants respectfully submits that the obviousness rejections under 35 U.S.C. §103(a) are improper, and requests that the Board of Patent Appeals and Interferences reverse these rejections on appeal.

Respectfully submitted,
MARTINE & PENILLA, LLP



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APPENDIX A

CLAIMS ON APPEAL

1. An apparatus for managing plasma in wafer processing operations, comprising:

a housing having an fluid entry port and a fluid exit port, the housing having an internal region defined by a top horizontal wall, a bottom horizontal wall and a circular side wall;

a plurality of baffle plates, each one of the plurality of baffle plates define a level in a multilevel structure formed in the internal region within the housing, each baffle plate being either separated from one another, or separated from either the top horizontal wall or the bottom horizontal wall by a separation spacing, each of the plurality of baffle plates including,

a plurality of holes, the plurality of holes in each of the baffle plates being oriented so that holes defined in each of the plurality of baffle plates are misaligned, thus defining a nonlinear path for fluids designed to enter the entry port, traverse each level of the multilevel structure defined by the plurality of baffle plates, the fluids capable of mixing together at each level of the multilevel structure, and leave the exit port of the housing; and

a gas inlet port in at least one of the separating spacing, the gas inlet port configured to inject gas into the housing in at least one of the separation spacing.

2. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the gas inlet port is in an uppermost separation spacing.

3. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the gas inlet port is in a lowermost separation spacing.

4. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein gas injected from the gas inlet port mixes with the plasma in the separation spacing.

5. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the plasma and the gas flowing through the nonlinear path within the housing undergoes turbulence and mixes.

6. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the nonlinear path is designed to cause recombination in fluid gas traversing through the housing.

7. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein each one of the plurality of baffle plates is circular.

8. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein each one of the plurality of baffle plates is oriented horizontally in the housing.

9. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the plurality of baffle plates includes 3 baffle plates.

10. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein each of the plurality of baffle plates provide a baffle surface area causing an increased impedance.

11. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the plasma is a downstream plasma.

12. An apparatus for optimizing plasma delivery in wafer processing operations comprising:

a housing configured to have a first chamber and a second chamber, the first chamber and the second chamber being separated by a wall having a plurality of orifices, the housing having an input port at a first end for supplying a plasma into the first chamber and an output port at a second end of the housing, the input port and the output port being aligned with each other, but misaligned with each of the plurality of orifices; and

at least one fluid input, the at least one fluid input being configured to supply fluid into at least one of the first chamber and the second chamber, the plasma supplied through the input port, the first chamber and the second chamber each capable of simultaneously mixing the fluid and the plasma;

wherein the output port at the second end enables the supplied plasma mixed with the fluid supply to exit the second chamber.

13. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein the at least one fluid input is configured to supply fluid into the first chamber.

14. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein the at least one fluid input is configured to supply fluid into the second chamber.

15. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein a first fluid inlet is configured to supply fluid into the first chamber and a second fluid inlet is configured to supply fluid into the second chamber.

16. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 15, wherein the first fluid inlet and the second fluid inlet are managed separately and may inject fluid individually or in combination.

17. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein the plasma is a downstream plasma.

18. An apparatus for managing plasma in wafer processing operations comprising:

a housing configured to have an internal region that is defined by an inner wall, the housing having an input port for supplying a plasma into the housing at a first end and an output port at a second end;

a hollow tube, the hollow tube being contained in the internal region within the housing, the hollow tube having a top and a bottom, the top connected to the first end and the bottom connected to the second end and further being defined by a wall that extends between the first end and the second end, the hollow tube containing a plurality of orifices that define a plurality of fluid paths through the wall; and

a fluid input, the fluid input being configured to supply fluid into the internal region of the housing, the supplied fluid capable of passing through the plurality of orifices in the wall of the hollow tube, the plasma supplied through the input port capable of being mixed within the hollow tube with the supplied fluid that enters the hollow tube through the plurality of orifices;

wherein the output port at the second end of the housing enables the mixed plasma and fluid supply to exit the housing.

19. An apparatus for managing plasma in wafer processing operations as recited in claim 18, further comprising:

a plasma generating source connected to the input port, the plasma generating source configured to produce the plasma.

20. An apparatus for managing plasma in wafer processing operations as recited in claim 18, further comprising:

a wafer processing chamber connected to the output port, the wafer processing chamber being configured to receive the mixed plasma from the output.

21. An apparatus for managing plasma in wafer processing operations as recited in claim 18, wherein turbulence is created inside the hollow tube through receipt of the supplied fluid through the plurality of orifices.

22. An apparatus for managing plasma in wafer processing operations as recited in claim 21, wherein the turbulence ensures mixing of the supplied fluid and the plasma.

23. An apparatus for managing plasma in wafer processing operations as recited in claim 18, wherein the plasma is a downstream plasma.